Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

280.37
F31A
cop.2

ARS 51-11
May 1967

MARKET QUALITY OF FILM-WRAPPED AND NAKED-PACKED HEAD LETTUCE

CURRENT SERIAL RECORDS

JUN 20 1967

U.S. DEPT. OF AGRICULTURE
NATIONAL AGRICULTURAL LIBRARY

Agricultural Research Service

UNITED STATES DEPARTMENT OF AGRICULTURE

ACKNOWLEDGMENTS

The cooperation and assistance of the following organizations or firms are gratefully acknowledged.

Shippers providing test cars:

Admiral Packing Co., Salinas, Calif.
Bud Antle, Inc., Salinas, Calif.
Bruce Church, Inc., Salinas, Calif.
Growers Exchange, Inc., Salinas, Calif.
Mutual Vegetable Sales, Salinas, Calif.

Shippers and organizations donating test lots of lettuce for evaluation after storage or transit:

Bud Antle, Inc., Salinas, Calif.
Growers Exchange, Inc., Salinas, Calif.
Grower-Shipper Vegetable Association of Central California, Salinas, Calif.

CONTENTS

	Page
Summary	3
Introduction	3
Methods	3
Results	5
Simulated shipping tests in laboratory	5
Shipping tests in rail cars	7
Conclusions	8

MARKET QUALITY OF FILM-WRAPPED AND NAKED-PACKED HEAD LETTUCE

By

Joseph K. Stewart, M. J. Ceponis, and C. M. Harris[1/]

SUMMARY

Quality differences between naked-packed and origin-wrapped lettuce generally were slight in simulated shipping tests made in the laboratory at Fresno, Calif., and also in actual shipping tests to the east coast. Crushing and bruising were more prevalent in naked-packed lettuce than in origin-wrapped lettuce in the holding tests at the laboratory but not in the actual shipping tests. Butt discoloration was slightly more severe in the naked-packed than in the origin-wrapped lettuce in lots examined at Fresno and in the lots examined on the east coast after 4 days at 50° F. However, the differences in butt discoloration were not significant at time of arrival on the east coast.

At the east coast, the quality of market-wrapped lettuce was generally better than that of either naked-packed or origin-wrapped lettuce because the defects that were present on arrival were removed before wrapping at the market.

INTRODUCTION

Shipments of individually wrapped heads of lettuce from western production areas to terminal markets have increased considerably since about 1962. Little information is available on the comparative market quality of film-wrapped (origin- and market-wrapped) lettuce and of conventional naked-packed lettuce. The quality of naked-packed, origin-wrapped, and market-wrapped lettuce was studied in six test shipments made from California to east coast markets between October 1963 and June 1965. The quality of origin-wrapped and naked-packed lettuce also was compared in holding tests at the U. S. Department of Agriculture's Horticultural Crops Research Laboratory at Fresno, Calif.

METHODS

Lettuce to be film-wrapped at origin (origin-wrapped) and that to be naked-packed was obtained from the same area of a commercial field. Film wrapping at origin was done either in the field or in the packing shed.

1/ Respectively, horticulturist, plant pathologist, and physiologist, Market Quality Research Division, Agricultural Research Service.

Polystyrene film was used for both origin and market wrapping. All origin-wrapped lettuce was passed through a heat tunnel to shrink the film. All operations at the shipping point, such as wrapping, packing, and vacuum cooling were done under commercial conditions. Each test carton contained 2 dozen lettuce heads. The naked-packed heads were packed in the bulge-pack carton (No. 7306).

Eight cartons of naked-packed lettuce and four cartons of origin-wrapped lettuce were placed in the middle layers of a car destined for the east coast. The transit temperatures of the lettuce ranged from 37° to 40° F. An additional 10 cartons of naked-pack lettuce and 10 cartons of origin-wrapped lettuce, all harvested from the same field as that shipped to the east coast, were transported under refrigeration to the Fresno, Calif., laboratory.

At Fresno, half of the heads from four cartons of naked-packed lettuce and half of the heads from four cartons of origin-wrapped lettuce were examined the day after harvest to determine the initial quality of the test lots of lettuce. This lettuce had been held overnight at 32° F. The initial quality of all test lots of lettuce was excellent, with no appreciable defects observed.

Two cartons of naked-packed and two cartons of origin-wrapped lettuce were held for either 7 or 8 days at 32°, 37°, or 41° F. to simulate shipment to the east coast. A temperature of 32° was included as it is the ideal temperature for shipping lettuce. Temperatures of 37° and 41° are less satisfactory, but temperatures in this range are commonly encountered in transit. One layer of heads from each carton was evaluated for quality immediately after the simulated shipping period and the remaining lettuce was evaluated after an additional 4 days at 50° F., a simulated wholesale-retail period.

At the east coast, personnel of the U. S. Department of Agriculture's Market Pathology Laboratory did the market wrapping and evaluated the test lettuce that was shipped. One-half the heads in each of four cartons of origin-wrapped and four cartons of naked-packed lettuce were observed at arrival, and the remaining lettuce was examined after an additional 4 days at 50° F.

Naked-packed lettuce in the four additional cartons was trimmed soon after arrival. The wrapper leaves and any cap leaves that were defective were removed. The heads were wrapped in 0.75 mil polystyrene film. One-half of the heads were passed for 3 seconds through a commercial-type heat tunnel at 300° F. to shrink the film. The other half was not heat treated. The market-wrapped heads were evaluated after 4 days at 50° F.

The same methods were used at the Fresno laboratory and the Market Pathology Laboratory to evaluate the lettuce. The general external appearance of each head was first observed and rated as excellent, good, fair, poor, or unsalable. Then each head was examined externally and internally for crushing and bruising, decay, tipburn, russet spotting, rib discoloration, and pink rib. Each head was torn apart for the internal examination. The

heads were rated for each of these disorders on the basis of whether or not the disorder was serious enough to affect its marketability. Butt discoloration was rated on the overall appearance of a half-carton sample (12 heads) rather than on an individual head basis. The rating scale for butt discoloration was 1, none; 2, trace; 3, slight; 4, moderate; and 5, severe.

When naked-packed lettuce was compared with any wrapped lettuce, the former was evaluated when trimmed to the first cap leaf. However, the wrapper leaves were left on the naked-packed heads during the 7- to 8-day holding period and also during the 4-day period at 50° F. These heads were trimmed just before evaluation.

The data were analyzed statistically by the analysis of variance and Duncan's multiple range test.

RESULTS

Simulated shipping tests in laboratory.--In the simulated shipping tests at Fresno, film-wrapping at origin significantly reduced the percentage of heads with commercially important crushing and bruising (table 1). In general, about twice as many naked-packed heads were seriously crushed and bruised as origin-wrapped heads. This was probably because the naked-packed heads have to be forced into the bulge-pack carton while the film-wrapped heads, which have been trimmed of their wrapper leaves, easily fit into their carton. Film wrapping at origin also significantly retarded butt discoloration during the simulated transit period. Further, butt discoloration did not increase so rapidly during 4 days at 50° F. in origin-wrapped lettuce as it did in naked-packed lettuce. In general, differences in butt discoloration were small even though statistically significant.

Packaging did not significantly influence the general appearance of the heads or the incidence of decay and pink rib.

Increasing temperatures from 32° to 41° F. significantly increased the percentage of heads rated low for general external appearance and, in general, significantly increased the percentage of heads with decay. Further, these effects of temperature during simulated transit not only persisted during the 4 days at 50° but increased during this period. Severity of butt discoloration also significantly increased with increasing temperature. These temperature effects were the same for both naked-packed and origin-packed lettuce.

Temperatures during simulated transit did not significantly influence incidence of pink rib. However, pink rib significantly increased in both naked-packed and origin-wrapped lettuce during the simulated wholesale-retail period.

Incidence of tipburn was not influenced by type of packaging, holding temperature, or time of examination. Russet spotting and rib discoloration were minimal in the lots of lettuce tested.

Table 1.--Lettuce condition at Fresno laboratory after holding at simulated transit and wholesale-retail conditions.

Type of packaging and simulated transit temperature (°F.)	Percentage of heads rated low in general external appearance 1/		Percentage of heads with indicated disorder 3/						Butt discoloration 4/	
			Crushing and bruising		Decay		Pink rib			
	On arrival 2/	After arrival + 4 days at 50°F.	On arrival 2/	After arrival + 4 days at 50°F.	On arrival 2/	After arrival + 4 days at 50°F.	On arrival 2/	After arrival + 4 days at 50°F.	On arrival 2/	After arrival + 4 days at 50° F.
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Naked-packed: 5/										
32 - - - - - -	4.2	21.4	12.5	14.3	1.2	3.6	3.0	14.9	2.7	3.8
37 - - - - - -	7.1	39.9	14.3	12.5	1.2	5.4	2.4	16.7	3.1	3.9
41 - - - - - -	8.3	52.4	11.9	14.3	4.2	17.9	5.4	20.8	3.6	3.9
Origin-wrapped:										
32 - - - - - -	3.0	21.4	3.6	6.5	.6	6.0	0	6.5	2.3	3.0
37 - - - - - -	4.2	32.7	5.4	7.1	3.0	6.5	2.4	12.5	2.8	3.1
41 - - - - - -	7.1	47.0	7.1	4.2	2.4	13.7	2.4	18.5	2.8	3.1
Statistical significance: 6/										
Packaging (P)-	NS		**		NS		NS		**	
Temperature (T)	**		NS		**		NS		**	
P x T - - - -	NS		NS		NS		NS		NS	
Time of examination (E)	**		NS		**		**		**	
P x E - - - -	NS		NS		NS		NS		*	
T x E - - - -	*		NS		*		NS		**	

1/ Percentage of heads rated fair, poor, or unsalable.
2/ After simulated transit period of 7 or 8 days at indicated temperatures.
3/ Percentage of heads with indicated disorders of commercial importance.
4/ Average discoloration rating: 1, none; 2, trace; 3, slight; 4, moderate; and 5, severe.
5/ Evaluated immediately after removal of wrapper leaves.
6/ NS, not significant; *, significant at 5-percent probability level; **, significant at 1-percent probability level.

Shipping tests in rail cars.--Type of packaging, naked-pack or origin-wrap, had no significant effect on the general external appearance, crushing and bruising, decay, or butt discoloration when the lettuce was examined at arrival (table 2). Although the percentages of heads with low quality ratings for external appearance were higher for the origin-wrapped heads than they were for the naked-packed heads (on arrival and also after 4 days at 50° F.) the differences were not statistically significant because of the great variability among replications.

Table 2.--Lettuce condition on arrival at the east coast and after an additional simulated wholesale-retail period of 4 days at 50° F.

Time of examination and type of packaging	Percentage of heads rated low in general external appearance 1/ 2/	Percentage of heads with indicated disorder 2/ 3/		Butt discoloration 2/ 4/
		Crushing and bruising	Decay	
	Percent	Percent	Percent	
On arrival:				
Naked-packed 5/	17.7 a	10.8 a	1.4 a	3.4 a
Origin-wrapped	33.7 a	14.6 a	3.1 a	2.8 a
After arrival plus 4 days: 6/				
Naked-packed 5/	57.9 ab	15.8 b	13.8 ab	4.1 c
Origin-wrapped	72.1 b	15.8 b	24.6 b	3.2 b
Market-wrapped:				
Heat tunnel	56.3 a	2.9 a	20.8 ab	2.7 ab
No heat	45.0 a	3.8 a	11.7 a	2.6 a

1/ Percentage of heads rated fair, poor, or unsalable.

2/ Means within a box not followed by the same letter are significantly different at the 5-percent probability level.

3/ Percentage of heads with indicated disorders of commercial importance.

4/ Average discoloration rating: 1, none; 2, trace; 3, slight; 4, moderate; and 5, severe.

5/ Evaluated immediately after removal of wrapper leaves.

6/ Held at 50° F.

Market-wrapped lettuce, in addition to the naked-packed and origin-wrapped lettuce, was evaluated after 4 days at 50° F. on the east coast. At this examination, the origin-wrapped lettuce was significantly poorer in external appearance than either the lot of market-wrapped lettuce passed through a heat tunnel or the lot that was not heated (table 2). Naked-packed and origin-wrapped lettuce did not differ significantly in general appearance at this

examination. Neither was there a significant difference in the general appearance of the market-wrapped lettuce that had passed through the heat tunnel and market-wrapped lettuce that had not been exposed to the heat. However, in other tests, lettuce was injured in heat tunnels under certain conditions. 2/

Naked-packed and origin-wrapped lettuce had significantly more crushing and bruising than market-wrapped lettuce, because the outer, crushed and bruised leaves were removed from the heads before wrapping at the market. Incidence of crushing and bruising was the same in naked-packed and origin-wrapped lettuce held for 4 days at 50° F. at the market.

Market-wrapped lettuce that had not passed through the heat tunnel had significantly less decay than origin-wrapped lettuce. Decay was not significantly different among the other lots of lettuce.

Butt discoloration was most severe in the naked-packed heads and it was least severe in the market-wrapped heads, because the stems of the market-wrapped heads had been trimmed at time of wrapping only 4 days before. Trimming the naked-packed lettuce for display would remove this difference.

Incidence of tipburn did not differ significantly among the four lots of lettuce after 4 days at 50° F. Rib discoloration, pink rib, and russet spotting were minimal in all lots.

CONCLUSIONS

It is important to provide transit temperatures as close to 32° F. as possible for lettuce. Low transit temperature not only maintains high quality until time of arrival at the market but prolongs the market life after arrival.

Crushing and bruising were significantly influenced by type of packaging after the simulated shipping tests but not after the actual shipping tests. This indicates that differences in crushing and bruising of naked-packed and origin-wrapped lettuce that occur during packing may be largely obscured by physical injury sustained during subsequent marketing operations.

The small difference in quality between origin-wrapped and naked-packed lettuce indicates that decisions on their relative merit should be influenced by factors other than quality. The economics of prepackaging lettuce at shipping point is discussed in another U. S. Department of Agriculture publication. 3/

2/ Ceponis, M. J., and Griffin, G. J. Effects of heat-tunnel temperatures on the quality of shrink-film-wrapped lettuce. U. S. Dept. Agr. Market. Res. Rpt. 634, 8 pp. 1963.

3/ Chapogas, P. G., and Stokes, D. R. Prepackaging lettuce at shipping point. U. S. Dept. Agr. Market. Res. Rpt. 670, 48 pp., illus. 1964.